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(54) **BICYCLE CHAIN**

(71) Applicant: **Jui-Chang Wu**, Tainan (TW)

(72) Inventor: **Jui-Chang Wu**, Tainan (TW)

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F16G 13/02 (2006.01)
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B62M 9/00 (2006.01)
B62M 9/06 (2006.01)

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(58) **Field of Classification Search**

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USPC 474/230
See application file for complete search history.

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Primary Examiner — Michael R Mansen

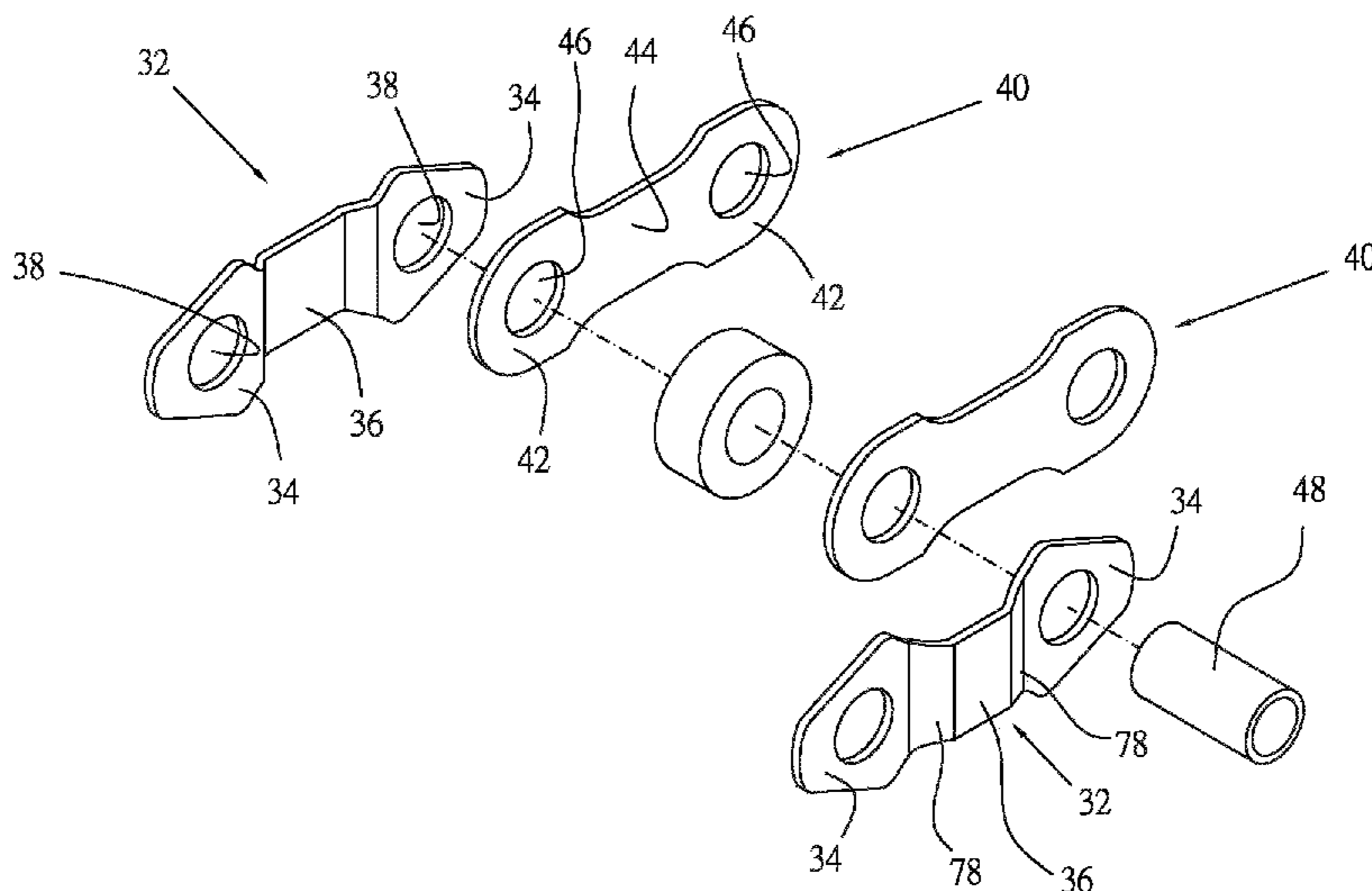
Assistant Examiner — Raveen J Dias

(74) *Attorney, Agent, or Firm* — Wang Law Firm, Inc.

(57) **ABSTRACT**

A bicycle chain includes a plurality of link units in series connection, and each of the link units includes two outer link plates, two inner link plates, and a pin. Each outer link plate includes two outer plate end portions and an outer plate connecting portion between to the outer plate end portions, and each outer plate end portion has a bore. Each outer plate end portion of the outer link plate has two cut portions on an edge thereof. The cut portions of the outer link plates provides a space, which is helpful to derailing the chain onto another sprocket in a low interference and a fast and smooth way.

6 Claims, 11 Drawing Sheets



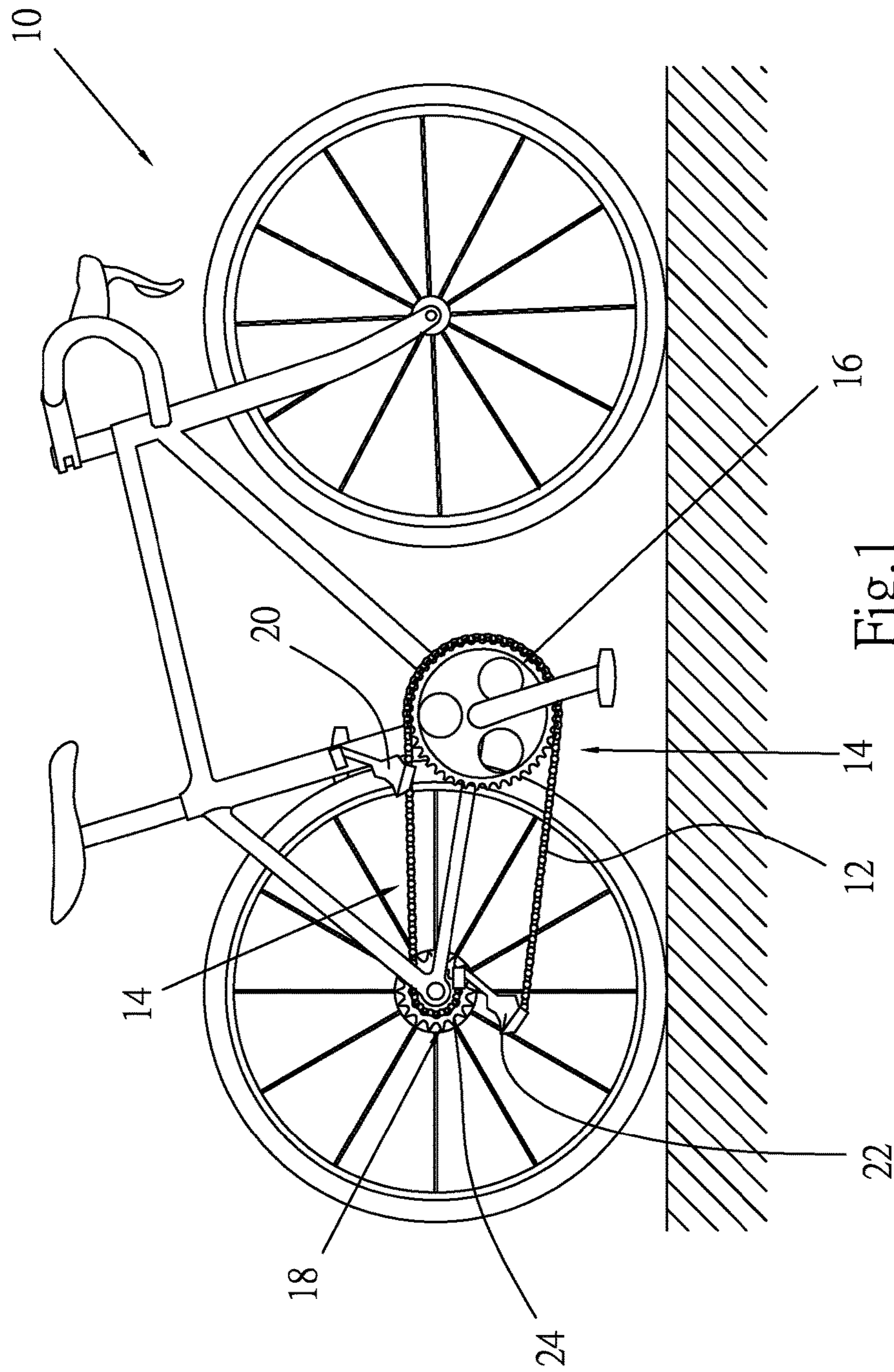
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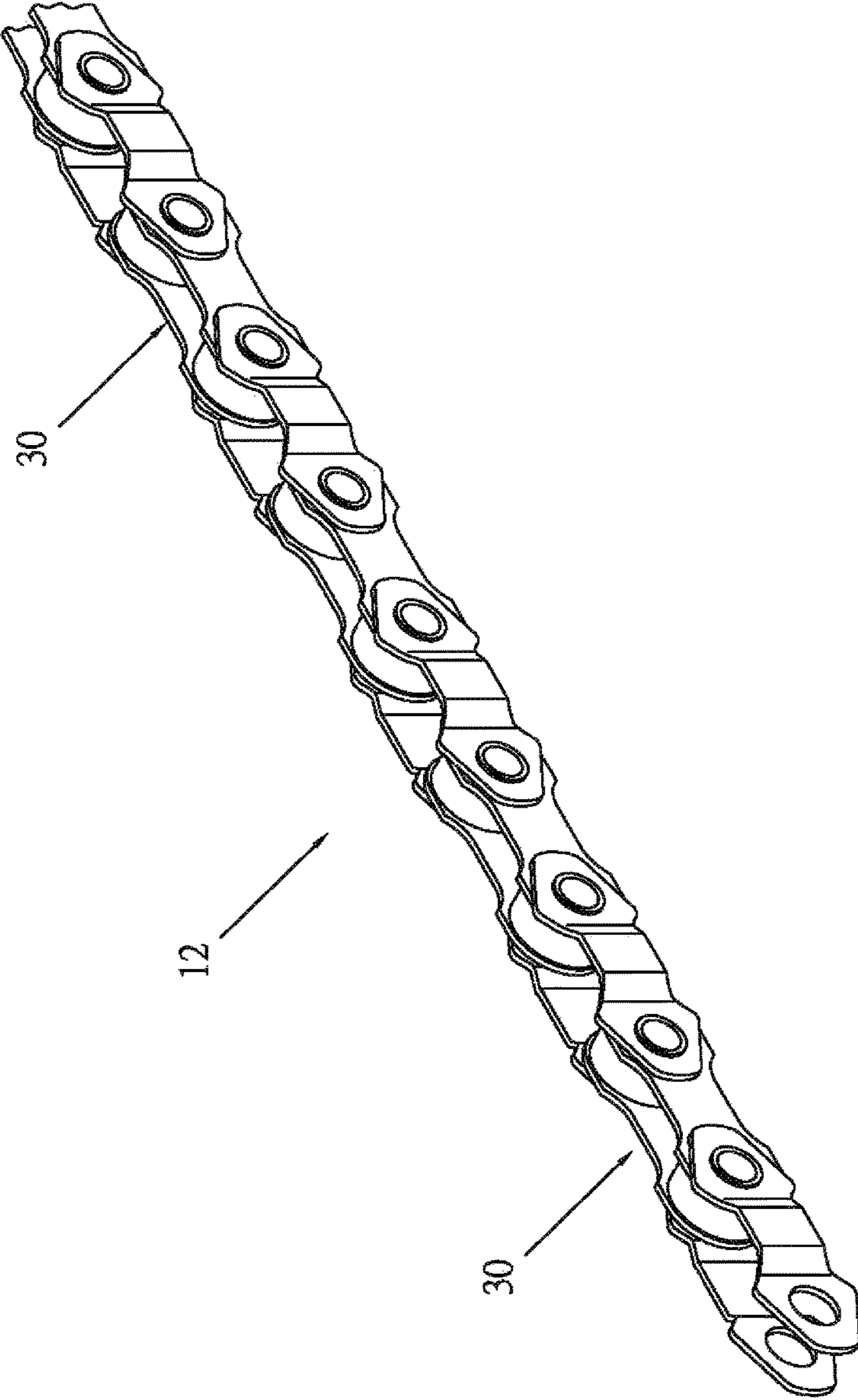


Fig.2

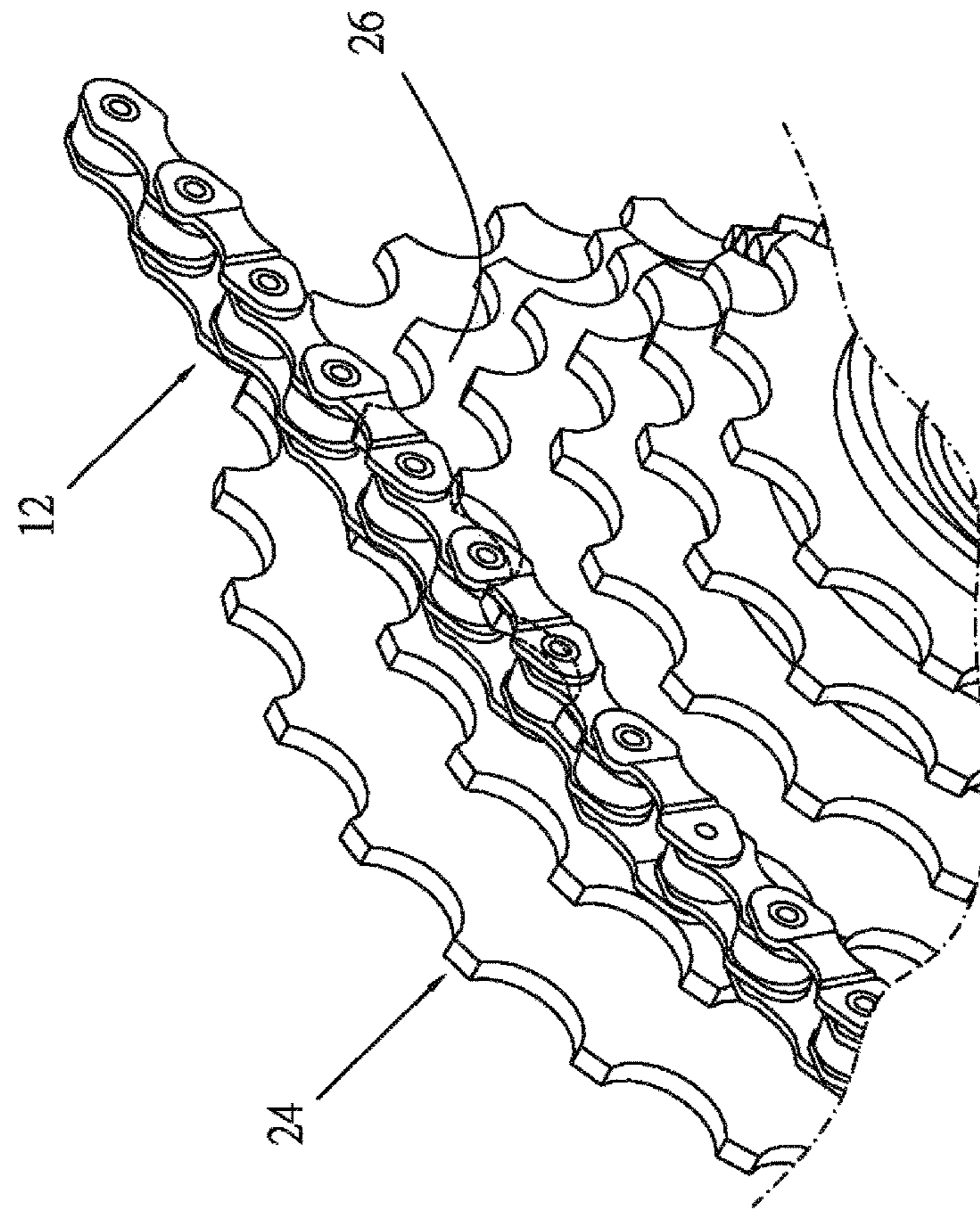


Fig.3

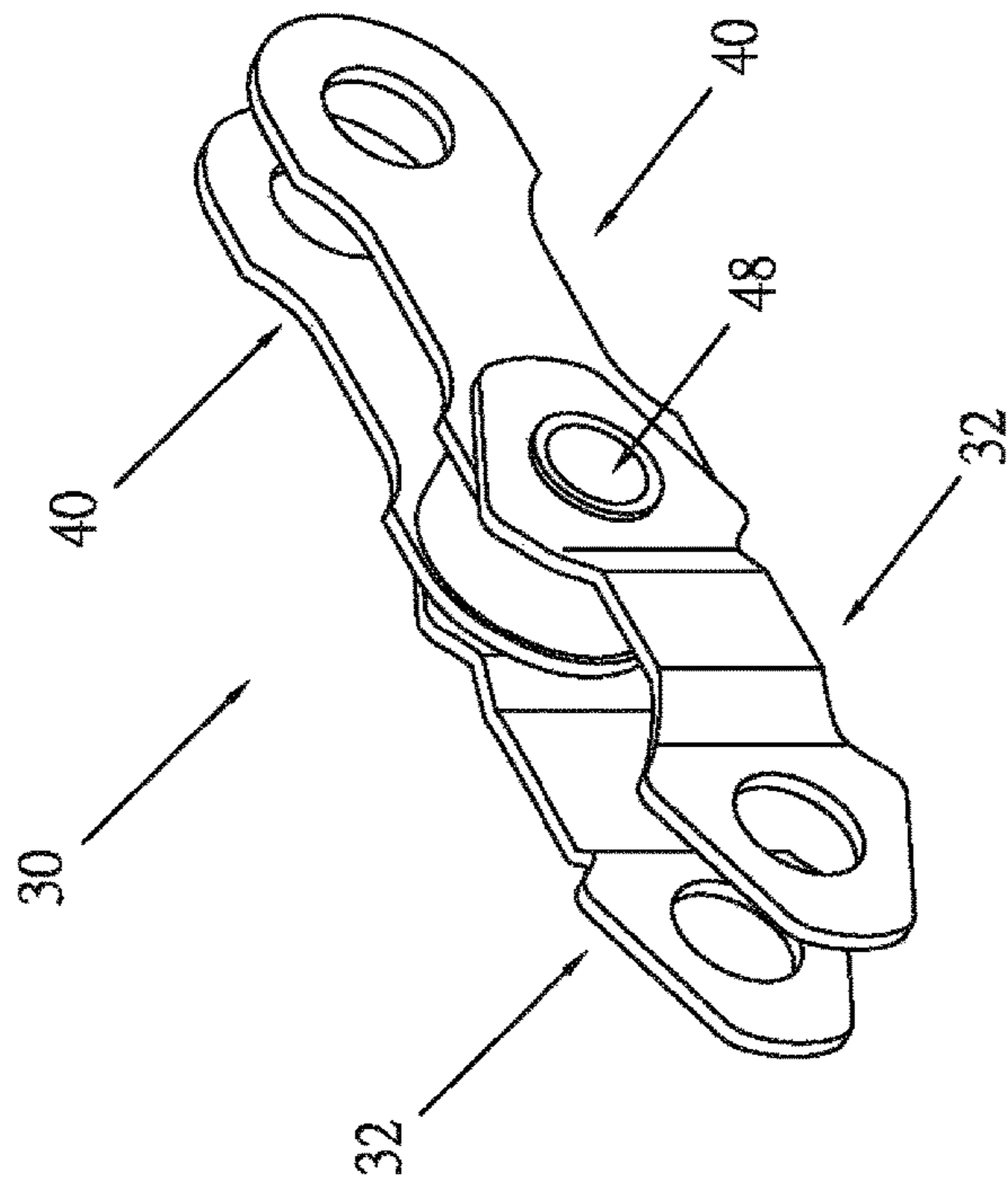


Fig.4

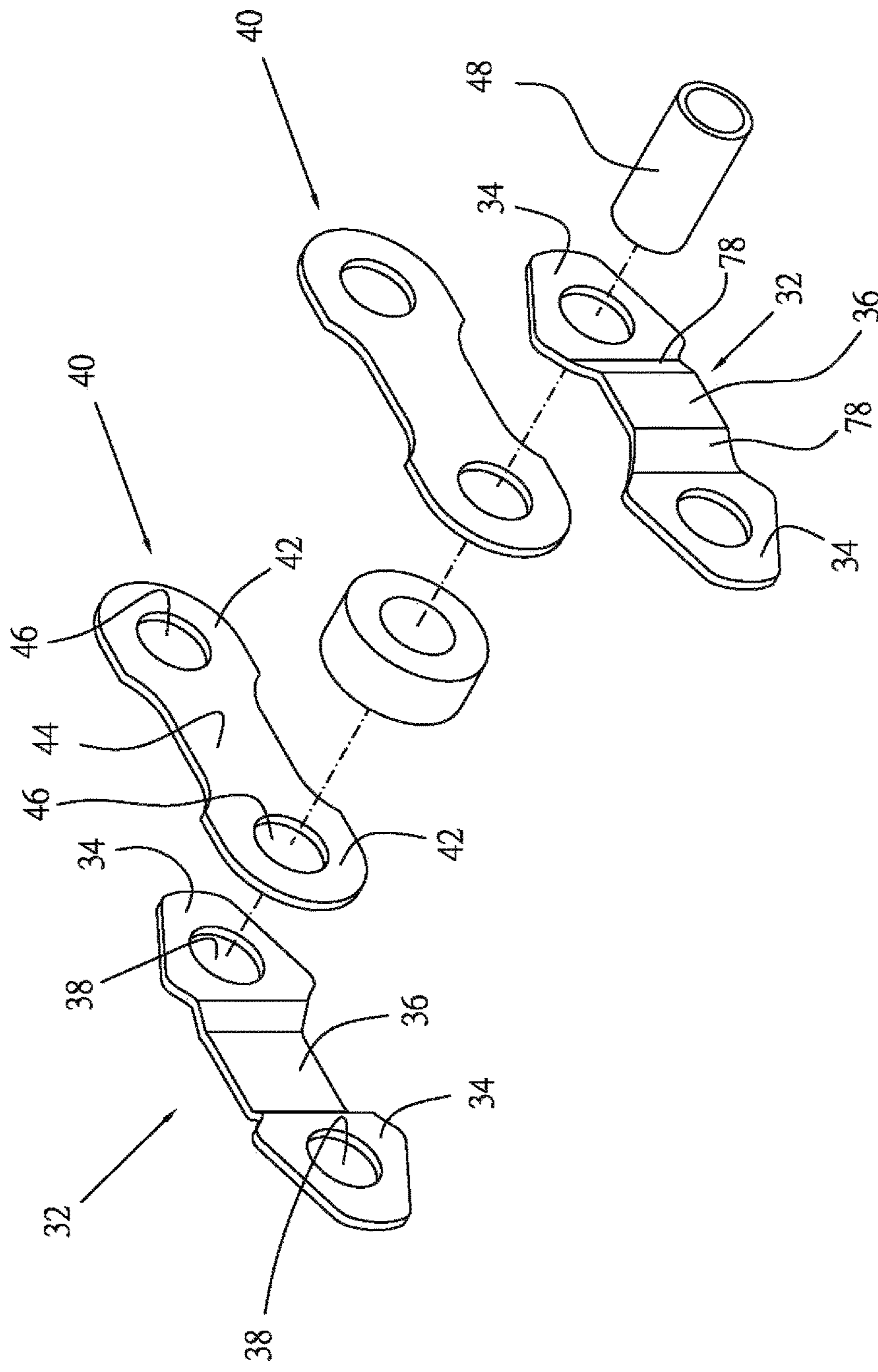


Fig. 5

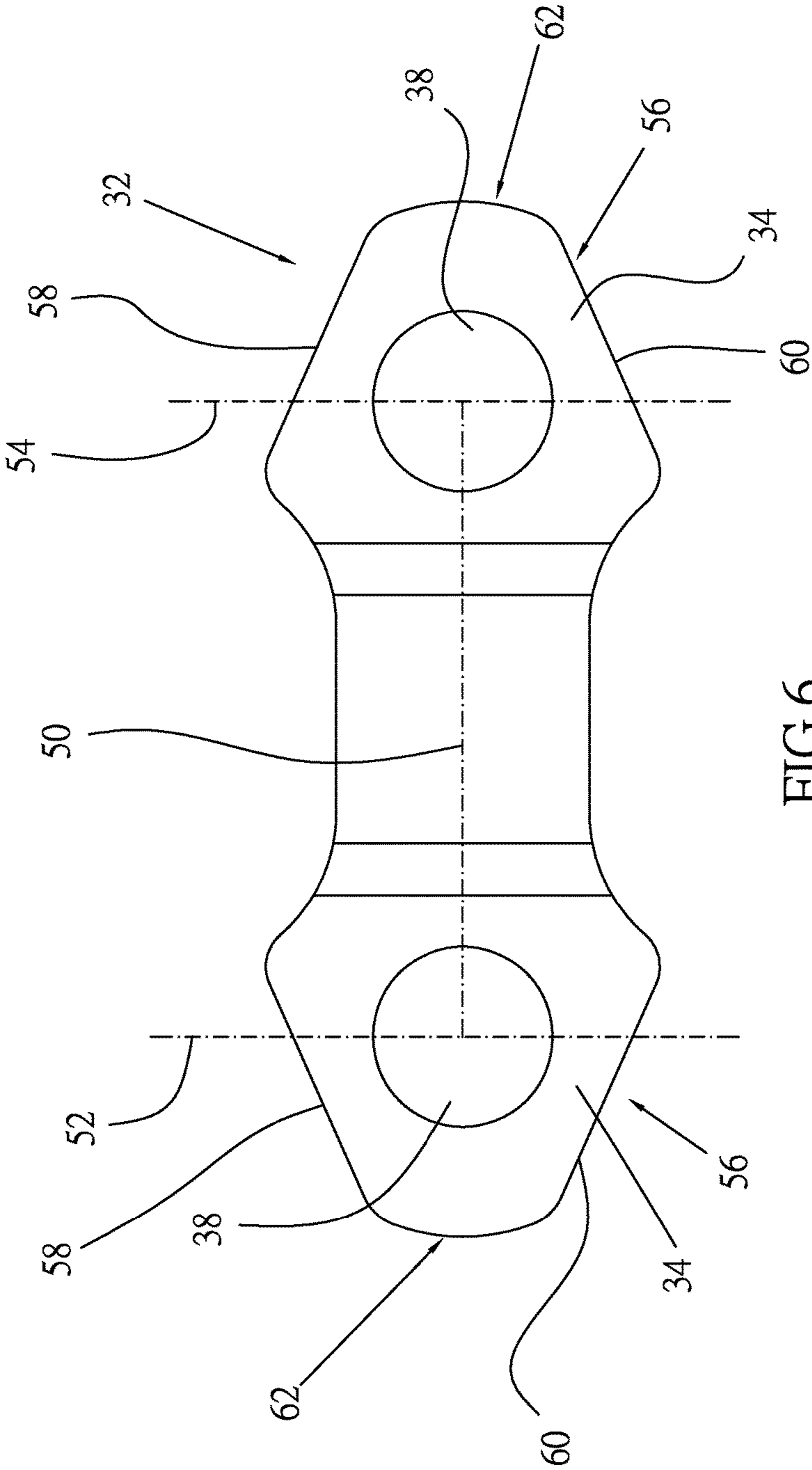


FIG.6

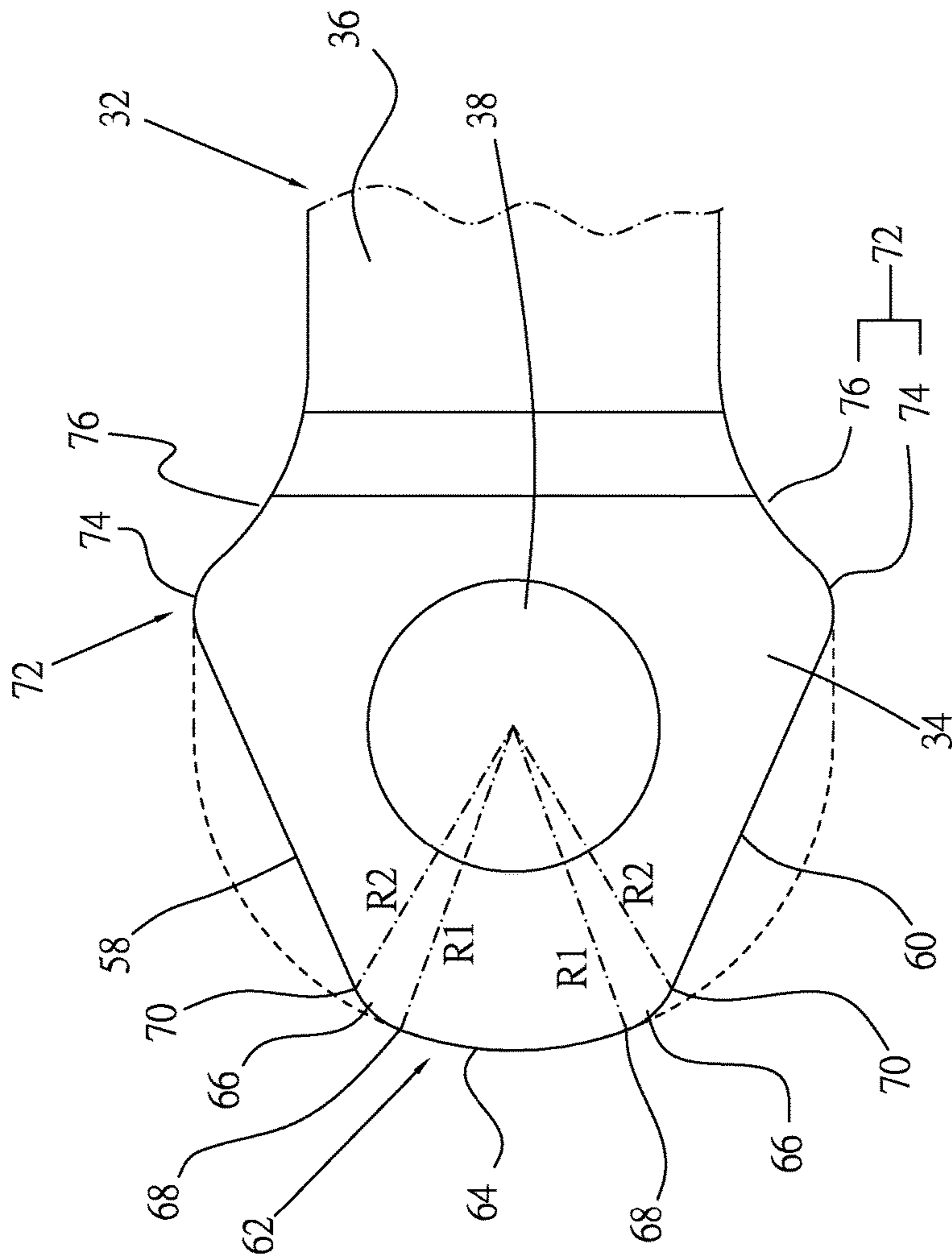


Fig.7

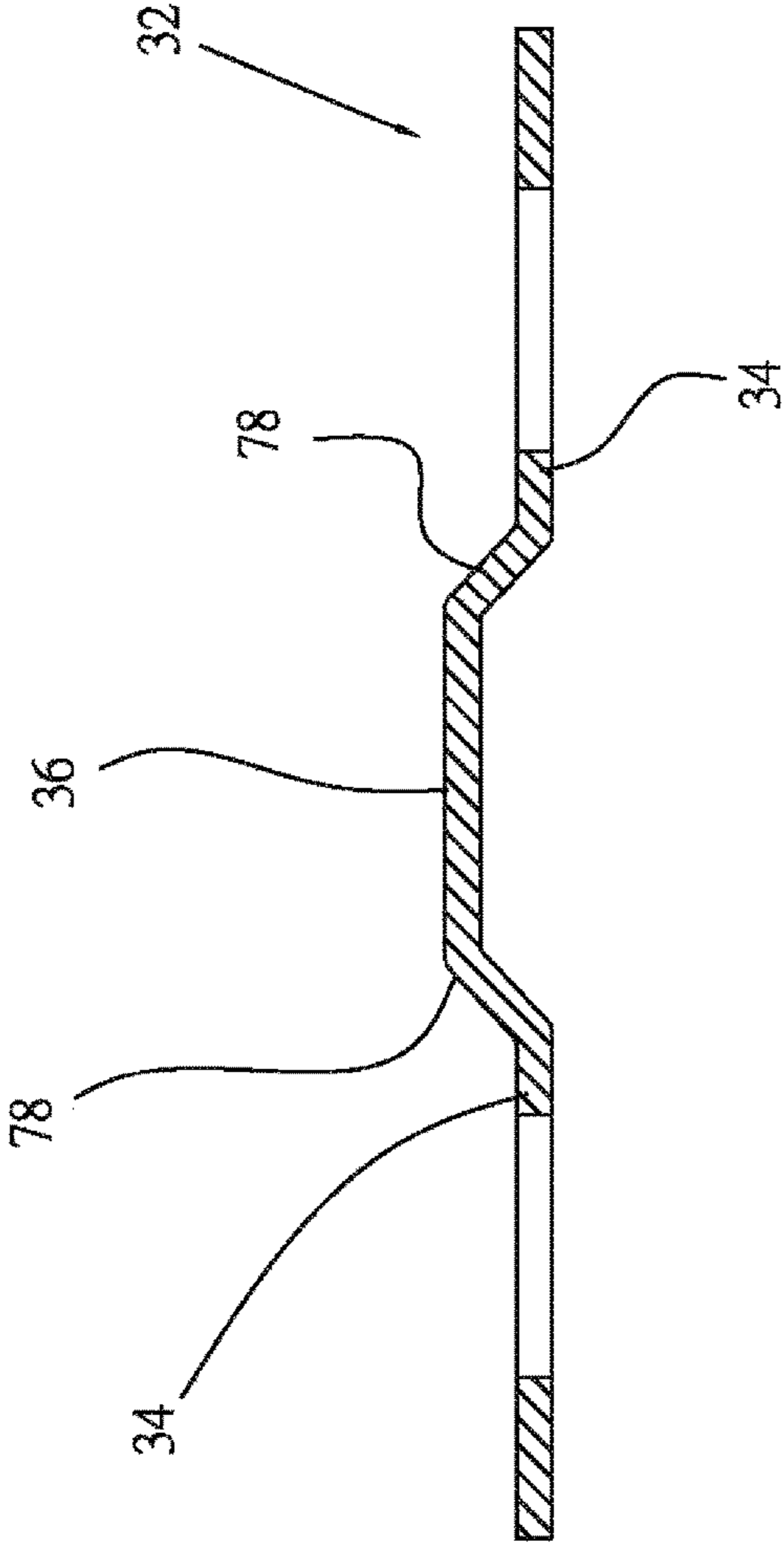


Fig.8

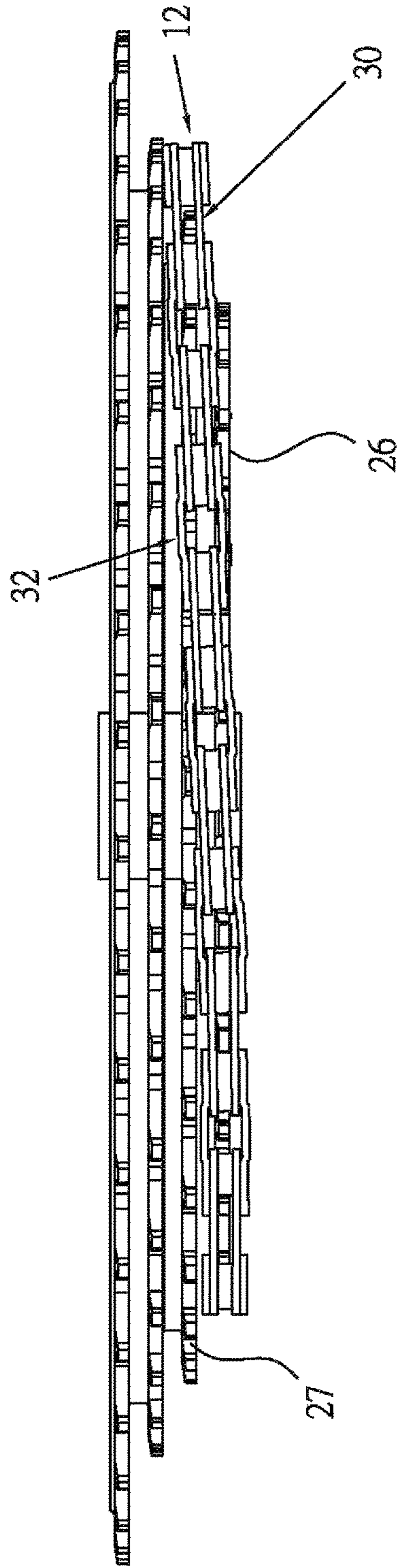


Fig.9

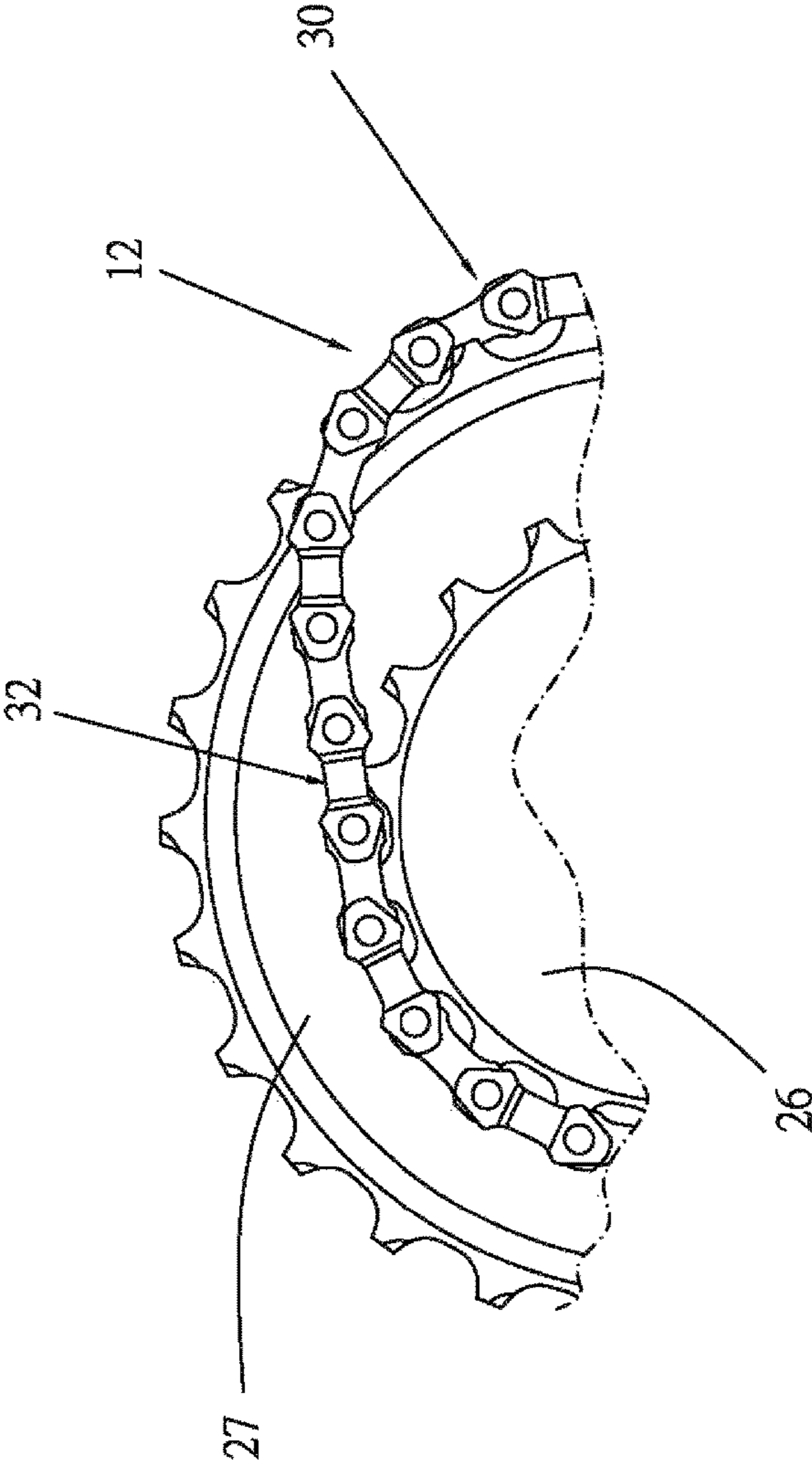


Fig.10

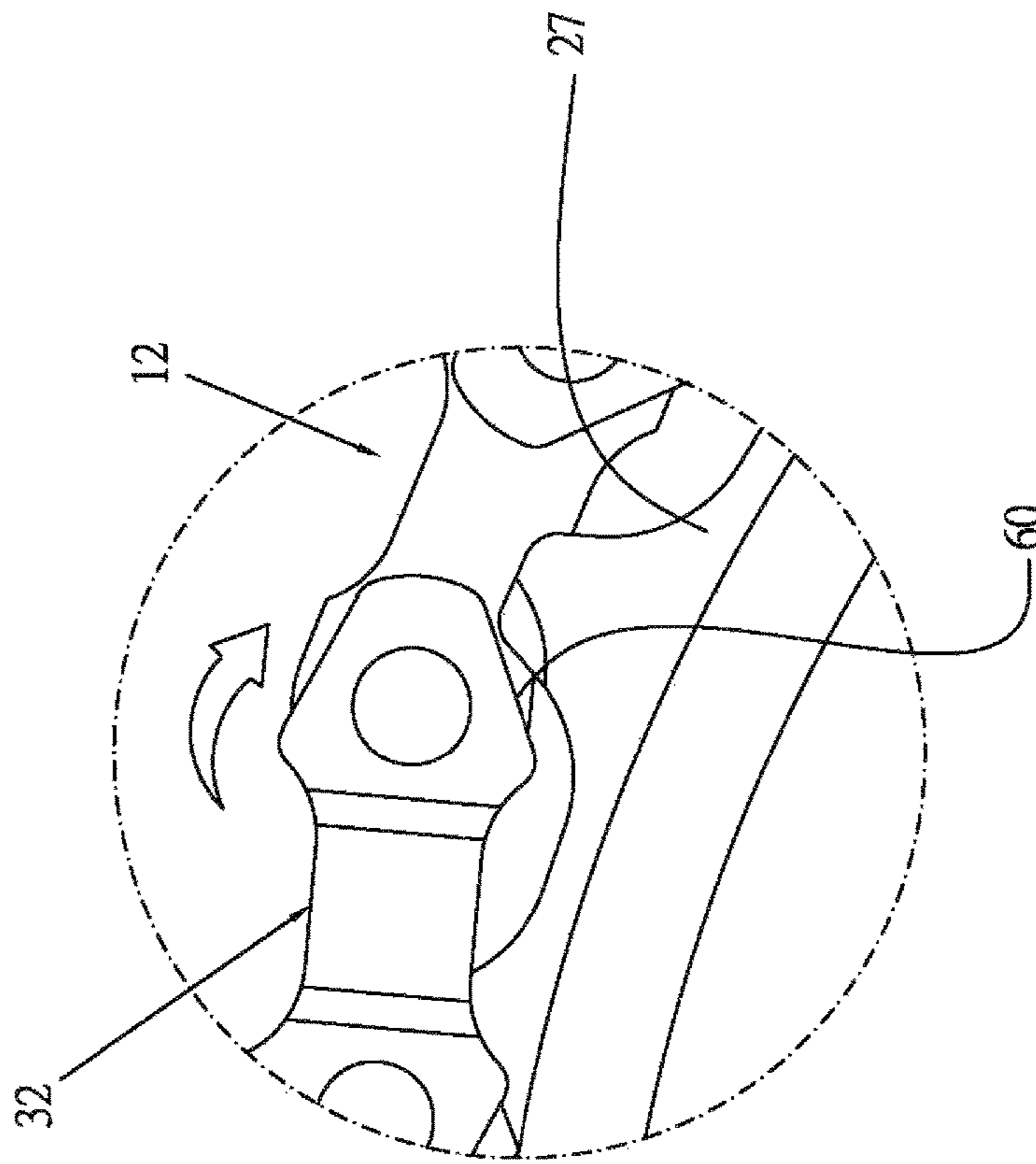


Fig. 11

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BICYCLE CHAIN

BACKGROUND OF THE INVENTION

1. Technical Field

The present invention relates to a bicycle, and more particularly to a bicycle chain.

2. Description of Related Art

Bicycle is a human-powered vehicle, having a frame, two wheels, and a drivetrain system. The drivetrain system includes a chain, a front crankset, a rear cogset, a front derailleur, and a rear derailleur. The derailleurs are operated to derail the chain onto different sprockets.

Typically, a conventional bicycle chain includes a plurality of inner links and outer links, which are connected by pins. In a transverse movement of the chain when derailing, the outer links tend to contact with the sprocket. To enhance a smooth transverse movement of the chain and reduce interference when derailing, the crankset is provided with recess or dents, or the chain has specific design.

U.S. Patents No. 2008/0119312 and U.S. Pat. No. 7,325,391 disclosed a bicycle chain, which provides dents on the outer links and inclined portions on opposite ends of the outer links. The dents reduce thicknesses of the outer links, and the inclined portions provide spaces for derailing the chain onto the other sprocket.

However, making dents on the outer links will complicate the manufacture process, and the inclined portion will reduce the strength of the outer link. Therefore, the prior art didn't provide a good solution.

BRIEF SUMMARY OF THE INVENTION

In view of the above, the primary objective of the present invention is to provide a bicycle chain, which provides a smooth movement of the chain when derailing.

The secondary objective of the present invention is to provide a bicycle chain, which provides a low torque loss and high torque output.

In order to achieve the objective of the present invention, a bicycle chain includes a plurality of link units in series connection, and each of the link units includes two outer link plates, two inner link plates, and a pin. Each outer link plate includes two outer plate end portions and an outer plate connecting portion between to the outer plate end portions, and each outer plate end portion has a bore. Each outer link plate is defined with a bore line, which extends through centers of the bores, and two radial lines, which extend through the centers of the bores respectively and are perpendicular to the bore line. Each outer plate end portion of the outer link plate has two cut portions on an edge thereof, and each cut portion has two inclined sections on opposite sides of the edge of the outer plate end portion. Opposite ends of the inclined sections are located at opposite sides of the radial lines. The inner link plates each has two inner plate end portions, and each inner plate end portion has a bore. The inner link plates are attached to inner sides of the outer link plates with the bores of the inner link plates aligned with the bores of the outer link plates respectively. The pin is inserted into the bores of the outer link plates and the inner link plates.

The cut portions of the outer link plates provides a space, which is helpful to derailing the chain onto another sprocket in a low interference and a fast and smooth way.

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BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

The present invention will be best understood by referring to the following detailed description of some illustrative embodiments in conjunction with the accompanying drawings, in which

FIG. 1 is a perspective view of the bicycle of a preferred embodiment of the present invention;

FIG. 2 is a perspective view of the chain of the preferred embodiment of the present invention;

FIG. 3 is a perspective view of chain and the sprockets of the preferred embodiment of the present invention;

FIG. 4 is a perspective view of the link unit of the preferred embodiment of the present invention;

FIG. 5 is an exploded view of the link unit of the preferred embodiment of the present invention;

FIG. 6 is a front view of the outer link plate of the preferred embodiment of the present invention;

FIG. 7 is an enlarged view of the outer link plate of the preferred embodiment of the present invention;

FIG. 8 is a top view of the outer link plate of the preferred embodiment of the present invention;

FIG. 9 is a sketch diagram of the link unit of the preferred embodiment of the present invention, showing derailing the chain;

FIG. 10 is another sketch diagram of the link unit of the preferred embodiment of the present invention, showing derailing the chain; and

FIG. 11 is an enlarged view of the link unit of the preferred embodiment of the present invention, showing derailing the chain.

DETAILED DESCRIPTION OF THE INVENTION

FIG. 1 shows a bicycle 10, which has a drivetrain system 14. The drivetrain system 14 includes a chain 12, a front crankset 16, a rear cogset 18, a front derailleur 20, and a rear derailleur 22. The derailleurs 20, 22 are operated to derail the chain 12 onto different sprockets of the front crankset 16 and the rear cogset 18.

The present invention provides a new design of the chain 12 to reduce the interference between the chain 12 and the sprockets of the front crankset 16 and rear cogset 18 when derailing the chain 12 through the derailleurs 20, 22.

As shown in FIG. 2, the chain 12 of the preferred embodiment of the present invention includes a plurality of link units 30 connected together to form the endless chain 12. As shown in FIG. 3, some of the link units 30 engage one of the sprockets 24 of the rear cogset 18, while some of them engage one of the sprockets of the front crankset 16.

As shown in FIG. 4, each of the link units 30 includes two outer link plates 32, two inner link plates 40, and a pin 48. The outer link plates 32 are parallel, and kept a distance from each other. The inner link plates 40 are parallel, and have portions attached to inner sides of the outer link plates 32 while opposite ends of the pin 48 are connected to the overlapped portions of the outer link plates 32 and the inner link plates 40.

As shown in FIG. 5, the outer link plate 32 has two outer plate end portions 34 and an outer plate connecting portion 36 with opposite ends connected to the outer plate end portions 34. Each of the outer plate end portions 34 has a bore 38. The inner link plate 40 has two inner plate end portions 42 and an inner plate connecting portion 44 with opposite ends connected to the inner plate end portions 42.

Each of the inner plate end portions **42** has a bore **46**. When the outer link plates **32** and the inner link plates **40** are assembled, the outer plate end portions **34** and the inner plate end portions **42** are overlapped, and the bores **38**, **46** thereon are aligned with each other for the pin **48** passing therethrough.

As shown in FIG. **6**, the outer link plate **32** is defined with a bore line **50**, which extends through centers of the bores **38**, and two radial lines **52**, **54**, which extend through the centers of the bores **38** respectively and are perpendicular to the bore line **50**.

The outer link plate **32** has two cut portions **56** on edges of the outer plate end portions **34** respectively, and each of the cut portions **56** includes two inclined sections **58**, **60** on opposite sides of the edge of the outer plate end portion **34**. The inclined sections **58**, **60** make the bore **38** closer to the edge of the outer plate end portion **34**. Furthermore, opposite ends of the inclined sections **58**, **60** are located at opposite sides of the radial lines **52**, **54** respectively.

The outer link plate **32** further has a curved section **62** on each of the edges of the outer plate end portions **34** respectively. Opposite ends of the curved section **62** are connected to the cut portions **56**. Preferable, the curved section **62** is between the inclined sections **58**, **60**, and connected thereto.

As shown in FIG. **7**, the curved section **62** has a front portion **64** and two connecting portions **66**. Each of the connecting portions **66** has opposite ends connected to the front portion **64** and the inclined sections **58**, **60** respectively. Two first connecting points **68** are defined between the connecting portions **66** and the front portion **64** respectively, and two second connecting points **70** are defined between the connecting portions **66** and the inclined sections **58**, **60** respectively. A first diameter **R1** is defined between the center of the bore **38** and the first connecting points **68**, and a second diameter **R2** is defined between the center of the bore **38** and the second connecting points **70**. The first diameter **R1** is greater than the second diameter **R2**, which means that the ends of the connecting portions **66** (the second connecting points **70**) are closer to the center of the bore **38** than the ends of the front portion **64** (the first connecting points **68**). It provides the inclined sections **58**, **60** has a great slope. Please referring to the dot lines in FIG. **7**, the inclined sections **58**, **60** provide a space for derailing, and a change of curvatures of the connecting portions **66** reduces a stress on the second connecting points **70**.

The outer link plate **32** further includes two extending curved sections **72** on each of the edges of the outer plate end portions **34** respectively. Each of the extending curved sections **72** has opposite ends connected to the end of the inclined sections **58**, **60** and the outer plate connecting portion **36**. Each of the extending curved sections **72** has an outward portion **74** and an inward portion **76**. The outward portion **74** has opposite ends connected to the inclined section **58**, **60** and the inward portion **76** while the inward portion **76** is connected to the outer plate connecting portion **36**. The opposite curvature design of the extending curved sections **72** reduces the stresses of the inclined sections **58**, **60**, the outer plate connecting portion **36**, as well as the portions nearby.

As shown in FIGS. **5** and **8**, the outer link plate **32** further includes two bent portions **78** between the outer plate end portions **34** and the outer plate connecting portion **36** respectively. The bent portions **78** make the outer plate end portions **34** and the outer plate connecting portion **36** not on the same plane.

The present invention reduces an area of the outer plate end portions **34**, and a distance between the inclined sections

58, **60** and the center of the bore **38**, so that the outer link plates **32** could be made of medium carbon steel with a suitable heat treatment to have a desirable strength at the inclined sections **58**, **60**. The design of the bent portions **78** increases a tensile strength of the outer link plates **32**. As a result, the chain **12** of the present invention has an essential strength.

As shown in FIGS. **9** and **10**, while the chain **12** is being derailed from a small sprocket **26** onto a big sprocket **27**, the chain **12** is forced toward the big sprocket **27** in a tilted condition, and the outer link plate **32** on the inner side is the first part arrived at the big sprocket **27**. The link units **30** will be closer to the big sprocket **27** than the prior art, so that teeth of the big sprocket **27** and the chain units **30** which are engaged with the big sprocket **27** are kept in the same direction. As a result, the teeth of the big sprocket **27** is located at centers of the chain units **30**.

As shown in FIG. **11**, since the chain **12** is tilted, the inclined sections **60** give a space to make the outer link plates **32** do not touch the big sprocket **27**.

In conclusion, the chain **12** of the present invention provides a space for derailing the chain **12** from the small sprocket **26**. With the tilting angle of the chain **12**, the chain could be derailed with a low interference.

Although the chain **12** is tilted and tensioned when derailing, it could make the teeth of the sprocket **26** engage the link units **30** at the centers thereof. Therefore, a relative angle between the chain **12** and the sprocket **26** is reduced. It could reduce the tilting angle and the tension of the chain **12**, furthermore, it could increase the mobility of the chain **12** to make it faster and smoother for derailing.

It must be pointed out that the embodiments described above are only some preferred embodiments of the present invention. All equivalent structures which employ the concepts disclosed in this specification and the appended claims should fall within the scope of the present invention.

What is claimed is:

1. A bicycle chain, comprising a plurality of link units in series connection, wherein each of the link units comprises:
 - two outer link plates, which are parallel to each other, each having two outer plate end portions and an outer plate connecting portion between the outer plate end portions, wherein each of the outer plate end portions has a bore;
 - wherein each of the two outer link plates is defined with a bore line, which extends through centers of the bores, and two radial lines, which extend through the centers of the bores respectively and are perpendicular to the bore line;
 - wherein each of the outer plate end portions of the two outer link plates has two cut portions on an edge thereof, and each of the cut portions has two inclined sections on opposite sides of the edge of the outer plate end portion; further wherein opposite ends of the inclined sections are located at opposite sides of the radial lines;
 - wherein each of the inclined sections of the two outer link plates has a straight portion and two curved portions at opposite ends of the straight portion, and on each of the two outer link plates the radial line crosses both of the two straight portions;
 - two inner link plates, which are parallel to each other, each having two inner plate end portions, and each of the inner plate end portions having a bore, wherein the inner link plates are attached to inner sides of the two

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outer link plates with the bores of the inner link plates aligned with the bores of the two outer link plates respectively; and

a pin inserted into the bores of the two outer link plates and the inner link plates.

2. The bicycle chain of claim 1, wherein each of the outer plate end portions of the two outer link plates has a curved section with opposite ends connected to the inclined sections.

3. The bicycle chain of claim 2, wherein the curved section has a front portion and two connecting portions; each of the connecting portions has opposite ends connected to the front portion and the inclined sections respectively.

4. The bicycle chain of claim 3, wherein two first connecting points are defined between the connecting portions and the front portion respectively, and two second connecting points are defined between the connecting portions and the inclined sections respectively; a first diameter is defined between the center of the bore and the first connecting points, and a second diameter is defined between the center

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of the bore and the second connecting points; the first diameter is greater than the second diameter.

5. The bicycle chain of claim 1, wherein each of the two outer link plates further includes two extending curved sections on each of the edges of the outer plate end portions respectively; each of the extending curved sections has opposite ends connected to the inclined sections and the outer plate connecting portion; each of the extending curved sections has an outward portion and an inward portion; the outward portion has opposite ends connected to the inclined section and the inward portion while the inward portion is connected to the outer plate connecting portion.

6. The bicycle chain of claim 1, wherein each of the two outer link plates further includes two bent portions between the outer plate end portions and the outer plate connecting portion respectively; whereby the outer plate end portions and the outer plate connecting portion are not on the same plane.

* * * * *